

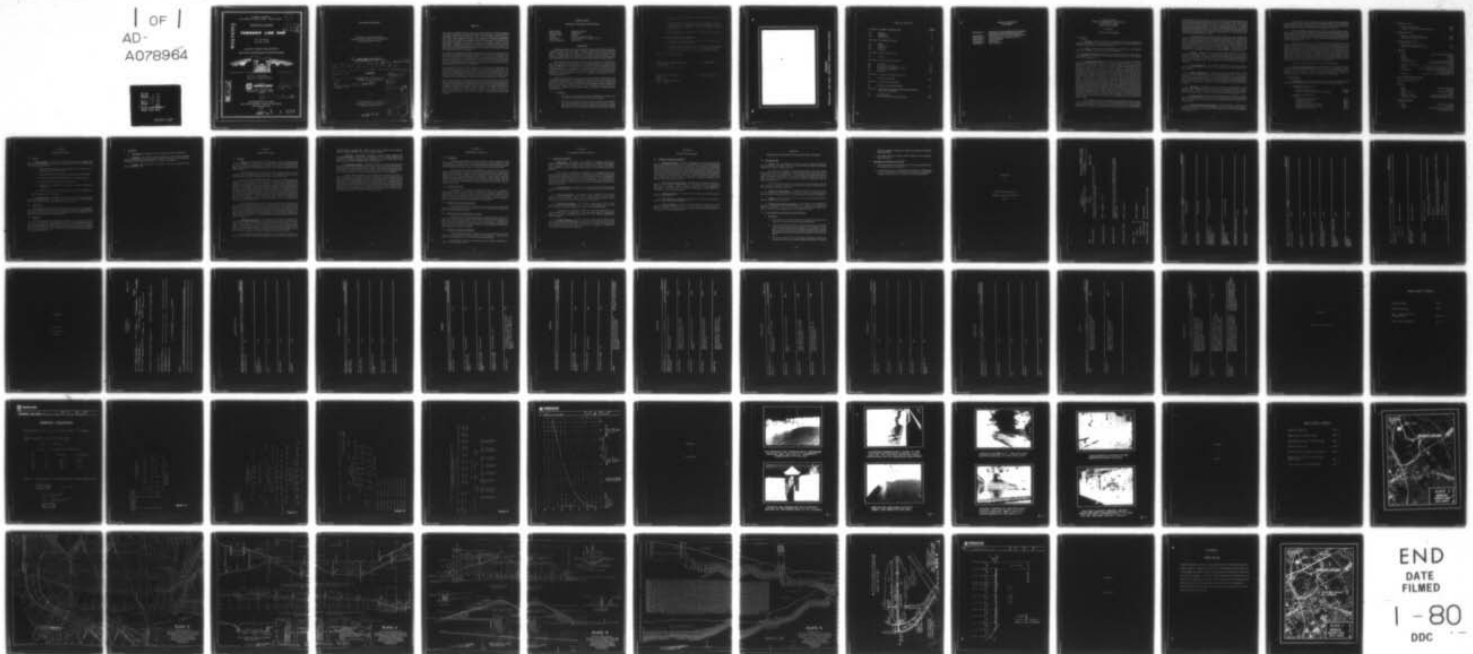
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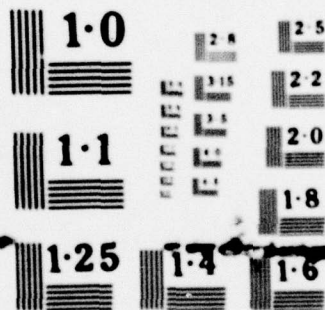
O'BRIEN AND GERE ENGINEERS INC PHILADELPHIA PA JUSTIN--ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. TOWNSHIP LINE DAM (NDI-PA 00625, P--ETC(U)
AUG 79 J J WILLIAMS DACW31-79-C-0010

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NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

DELAWARE RIVER BASIN
EAST BRANCH OF CHESTER CREEK, CHESTER COUNTY

ADA078964

PENNSYLVANIA

LEVEL

TOWNSHIP LINE DAM

NDI - PA 00625
PA DER 15-266

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

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AUGUST 1979

DELAWARE RIVER BASIN

Name of Dam: Township Line Dam
County & State: Chester County, Pennsylvania
Inventory Number: PA 00625

⑩ John J. Williams

⑥ PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Township Line Dam (NDI-PA 00625, PA DER 15-266)
Delaware River Basin, East Branch of
Chester Creek, Chester County, Pennsylvania.
Phase I
Inspection Report.

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

⑪ Aug 79

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DACW31-79-C-00101

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For

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Township Line Dam
State Located:	Pennsylvania
County Located:	Chester
Stream:	East Branch Chester Creek
Coordinates:	Latitude 39° 59.1', Longitude 75° 34.3'
Date of Inspection:	June 12, 1979

ASSESSMENT

Township Line Dam is an earth embankment approximately 530 feet long with a height of 34 feet and crest width of 10 feet. The dam is located immediately west of Township Line Road about 2 miles northeast of West Chester, Pennsylvania. The dam, originally constructed to impound and supply water for the Borough of West Chester, is presently being used for recreation, flood abatement and maintenance of a minimum discharge into the East Branch of Chester Creek.

The concrete Ogee spillway has a crest width of 50 feet and is located at the south dam abutment. The spillway, for this "Intermediate" size, "High" hazard dam, is capable of discharging 48 percent of the PMF without overtopping of the earth embankment. A review of the hydrologic analysis indicates that the embankment would be overtopped by 0.15 feet for about 2 hours during a flood equal to 50 percent of the PMF. It is considered unlikely that the dam would fail during this event; therefore, the spillway is classified as "Inadequate", but not "Seriously Inadequate".

Based upon visual observations, review of the information obtained from the Pennsylvania Department of Environmental Resources, Division of Dam Safety, and conversations with the Owner's representative, Township Line Dam is considered to be in fair condition. However, the detection of potentially unstable conditions at this site was severely restricted due to thick vegetation covering the entire embankment. Conditions which require further investigations, maintenance, or monitoring are:

a. Facilities

1. The capacity of the spillway should be increased in accordance with the results of further hydrologic and hydraulic studies.
2. The thick vegetation and trees should be removed from the embankment crest and slopes under the guidance of an engineer. If any signs of distress such as seepage, sloughing or cracking are revealed, the stability of the embankment should be reevaluated by a licensed

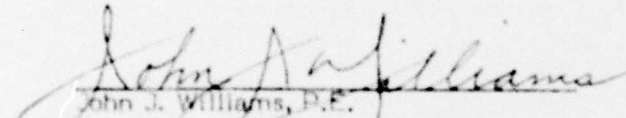
professional engineer experienced in the design and construction of dams.

3. The exact location of the 8-inch diameter vitrified clay outlet pipe connected to the toe drain system should be determined. The pipe should be regularly inspected to detect any changes in discharge and/or turbidity.
4. The riprap should be replaced where necessary on the upstream slope of the dam.

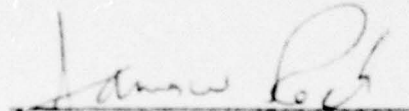
b. Operation And Maintenance Procedures

1. A program should be initiated for removal of excess vegetation from the embankment on a regular basis.
2. A downstream warning system should be developed. During periods of heavy rainfall, the dam should be monitored and downstream residents should be alerted in the event of an impending failure.

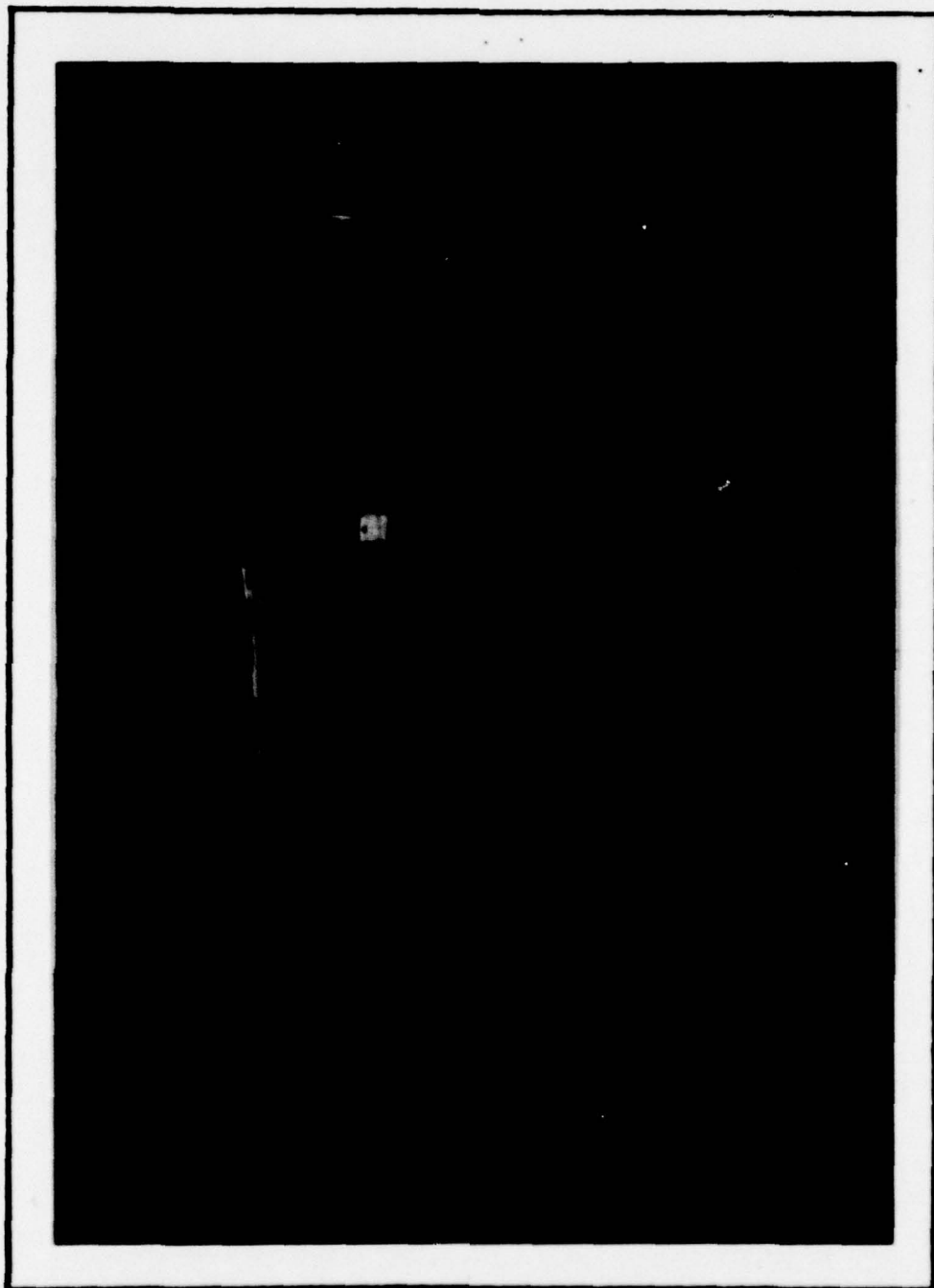
O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION


John J. Williams, P.E.
Vice President
Pennsylvania Registration PE 06920

Date: 5 Sept. 1979


Approved By :
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 19 Sep 1979



*OVERVIEW
TOWNSHIP LINE DAM, CHESTER COUNTY, PENNSYLVANIA*

TABLE OF CONTENTS

	<u>PAGE</u>
SECTION 1 - PROJECT INFORMATION	
1.1 General	1
1.2 Description	1
1.3 Pertinent Data	3
SECTION 2 - ENGINEERING DATA	
2.1 Design	5
2.2 Construction	5
2.3 Operation	5
2.4 Evaluation	6
SECTION 3 - VISUAL INSPECTION	
3.1 Findings	7
SECTION 4 - OPERATIONAL FEATURES	
4.1 Procedures	9
4.2 Maintenance of the Dam	9
4.3 Maintenance of Operating Facilities	9
4.4 Warning System in Effect	9
4.5 Evaluation	9
SECTION 5 - HYDRAULICS AND HYDROLOGY	
5.1 Evaluation of Features	10
SECTION 6 - STRUCTURAL STABILITY	
6.1 Evaluation of Structural Stability	11
SECTION 7 - ASSESSMENT, RECOMMENDATIONS, PROPOSED REMEDIAL MEASURES	
7.1 Dam Assessment	12
7.2 Recommendations, Remedial Measures	12

TABLE OF CONTENTS
(Continued)

APPENDIX A -	CHECKLIST, ENGINEERING DATA, DESIGN CONSTRUCTION, OPERATION, PHASE I
APPENDIX B -	CHECKLIST, VISUAL INSPECTION, PHASE I
APPENDIX C -	HYDROLOGIC & HYDRAULIC DATA
APPENDIX D -	PHOTOGRAPHS
APPENDIX E -	DRAWINGS
APPENDIX F -	SITE GEOLOGY

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
TOWNSHIP LINE DAM
NDI I.D. NO. PA 00625

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the Township Line Dam constitutes a hazard to human life or property.

1.2 Description of Project (Based upon information obtained from the Pennsylvania Department of Environmental Resources (DER), Division of Dam Safety, Harrisburg, Pennsylvania).

a. Dam And Appurtenances. Township Line Dam is an earth embankment, approximately 530 feet in length with a maximum height of 34 feet. The dam impounds a reservoir with a surface area of 65 acres and a storage capacity of 597 acre-feet at normal pool. The top of the dam is about 10 feet wide and the downstream slope is 2 horizontal to 1 vertical (2H:1V). The upstream slope is 2.5H:1V from the dam crest to a 5-foot wide berm at Elevation 408.0 and below the berm the slope is 3H:1V. The upstream slope is protected by an 18-inch thick layer of hand placed riprap from the berm to Elevation 418.5. The embankment is composed of an impervious central core with an outer shell of semi-pervious rolled earth. The central core is 10 feet wide at the dam crest and has side slopes of 1H:4V. A key trench of impervious material extends the impervious core to underlying bedrock and has side slopes of 1H:1.75V. A concrete corewall which extends to foundation bedrock is located along the centerline of the key trench. The corewall is 4 feet wide at the base and reduces to 1-foot wide at the top with varying side batters which are dependent upon the height of wall. A grout curtain consisting of one row of grout tubes, 3 feet center to center, extends below the concrete corewall and about 15 feet into bedrock. A two foot deep toe drain is buried beneath the rock fill toe of the downstream slope. The outlet for the drain consists of a 6-inch vitrified clay pipe which discharges to either the reservoir outlet channel or to an 8-inch vitrified clay pipe draining into the East Branch of Chester Creek.

The reinforced concrete Ogee spillway, constructed at the south abutment, is 50 feet wide and has a 6-foot drop from the weir crest (Elevation 414.0) to the downstream apron. Concrete training walls form a 40-foot long approach channel having a 12-inch thick concrete invert which slopes from Elevation 409.0

(32 feet upstream of the spillway crest) to Elevation 411.0 (approximately 4 feet upstream of the spillway crest). The concrete lined wasteway channel extends 185 feet downstream from the spillway crest on an 8 percent slope. The channel reduces in width from 50 feet to 15 feet and directs overflow into a concrete cascading-step energy dissipator. The 7-step cascade drops about 8.5 feet, and is provided with a 20-foot long concrete plunge pool. The remaining 220 feet of the wasteway channel consists of a riprapped trapezoidal section directing discharge into the East Branch of Chester Creek.

A stone masonry and reinforced concrete intake structure founded upon bedrock is constructed at the toe of the upstream embankment slope. Two 24-inch cast iron inlet pipes controlled by hand operated gate valves are located in the tower at Elevation 400.0 and Elevation 407.0. A 24-inch diameter gated reservoir drain is located at the base of the intake structure at Elevation 388.0. All discharges from the tower flow through a 42-inch diameter outlet conduit which terminates 122 feet downstream at a concrete headwall. The outlet conduit discharges into a riprapped, trapezoidal channel leading to the wasteway channel.

b. Location. Township Line Dam is located on the East Branch of Chester Creek about 2 miles northeast of the Borough of West Chester. The dam is situated in West Goshen Township, Chester County, Pennsylvania and is shown on the USGS Quadrangle entitled "West Chester, PA" at coordinates N 39° 59.1', W 75° 34.3'. A regional location plan of Township Line Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. The maximum height of 34 feet and maximum storage capacity of 1,150 acre-feet place Township Line Dam in the "Intermediate" size category.

d. Hazard Classification. Township Line Dam is located about 2 miles upstream of Milltown Reservoir on the East Branch of Chester Creek. A failure or overtopping of the Township Line structure would allow flood waters to discharge into the downstream impoundment. This might cause failure or overtopping of the Milltown Dam and result in the possible loss of many lives and extensive property damage in the community of Milltown. Therefore, the dam is in the "High" hazard category.

e. Ownership. Township Line Dam is owned by the Borough of West Chester, 15 South High Street, West Chester, PA. According to Mr. David Hughes, Manager, West Chester Municipal Water Authority, negotiations are currently under way to sell the dam site to Chester County for use as a possible park area.

f. Purpose of Dam. The dam, originally constructed to impound and supply water for the Borough of West Chester, is presently being used for recreation, flood abatement and maintenance of a minimum discharge into the East Branch of Chester Creek.

g. Design And Construction History. Township Line Dam was designed by I.S. Walker, Consulting Engineer, Philadelphia, PA, and was constructed by William Steele and Son Company. The construction began in July, 1934 and was completed in December, 1935.

The DER files contain monthly construction progress reports submitted by the designer to Mr. Charles M. Ryder, Secretary, Water & Power Resources Board, Commonwealth of Pennsylvania and a number of field inspection reports prepared by Mr. C.K. Weigle of the Water & Power Resources Board.

The only significant design change reported in the correspondence is Mr. Walker's decision to construct the concrete spillway channel and training walls with steel reinforcement, expansion joints and larger pour sections. The design change was approved by Mr. Ryder provided that weep holes be incorporated through the training walls and spillway slabs. Sketches indicating the spillway redesign are included in the DER files.

During a site inspection on May 21, 1935, the State's representative, Mr. Weigle, noted that the fill in the core trench was being hand placed and then moistened using buckets of water splashed across each lift. He further noted the presence of solid ridges and water-filled depressions in the fill surface; the depressions being filled with loose material prior to rolling. Mr. Weigle, in his field notes, and Mr. Ryder, by letter to Mr. Walker, directed that each lift be evenly spread and rolled using the proper equipment and that water supply lines be installed to sprinkle the embankment as necessary. The designer replied by letter that the poor construction methods were being employed in his absence and that proper procedures would be used in the future by the contractor.

There is no record of post-construction changes at the site.

h. Normal Operating Procedures. According to the Owner's representative the reservoir is normally maintained at or near the spillway crest elevation. Inflow occurring when the reservoir is at or above the spillway crest elevation is discharged over the spillway. The outlet works are operated as required to maintain a minimum discharge into the East Branch of Chester Creek.

1.3 Pertinent Data

a. Drainage Area. The drainage area above the dam is 2.9 square miles, as taken from information provided by DER and verified on topographic maps.

b. Discharge at Dam Site. (cfs)

Maximum Storm of Record	Unknown
Spillway Discharge (Reservoir at Top of Dam)	2,800

c. Elevation. (feet above MSL)

Spillway Crest (normal pool)	414.0
Low Point Top of Dam	419.7
Design Top of Dam	420.0
Reservoir Drain Invert (24" inlet)	388.0
Reservoir Drain Invert (42" outlet)	386.3
Streambed at Toe of Dam	386.0

d. Reservoir. (miles)

Length of Normal Pool	0.80
Length of Maximum Non-Overtopping Pool	1.30

e. Storage. (acre-feet)

Normal Pool, Elevation 414.0	597
Design Top of Dam, Elevation 420.0	1,150

f. Reservoir Surface. (acres)

Normal Pool, Elevation 414.0	65
Design Top of Dam, Elevation 420.0	124

g. Dam Data.

Type	Compacted earth embankment
Length	530 feet
Height	34 feet
Crest Width	10 feet
Side Slope (upstream)	2.5H:1V Dam crest to Elev. 408 3H:1V Elev. 408 to the toe of slope
Side Slope (downstream)	2H:1V
Zoning	Impervious core and semi-pervious shell
Cut-Off	Impervious key trench and concrete core wall
Grout Curtain	Single-row grout curtain extending 15 feet into bedrock
Toe Drain	6-inch VCP in gravel at downstream toe

h. Diversion And Regulating Tunnel.

Does not apply to this site.

i. Spillway.

Type	Concrete Ogee Weir
Width	50 feet
Crest Elevation	414 feet above MSL
Gates	None
Upstream Channel	Reinforced Concrete Approach
Downstream Channel	Reinforced Concrete Channel

j. Regulating Outlets.

Type	42-inch cast iron pipe
Length	112 feet
Closure	42-inch hand operated gate valve in the intake tower

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. The information available for review of Township Line Dam includes the following (all information contained in the DER main office files in Harrisburg, Pennsylvania):

1. "Application", "Report upon the Application" and "Permit" to construct Township Line Dam; 1933.
2. Design drawings including sketches showing the spillway redesign.
3. Construction progress reports, photos and contractor's invoices.
4. As-Built profile of corewall and grout curtain.
5. Miscellaneous correspondence, inspection reports, construction reports, etc.
6. Spillway discharge calculations pursuant to addition of flashboards.

Note: Design data is not available.

b. Design Features. The design features are described in Section 1.2.a. (Description of Project, Dam and Appurtenances). The principal design features for the structure are shown on Plates 2 through 5, Appendix E.

2.2 Construction

The construction information made available consisted of correspondence between the designer and the Water & Power Resources Board, Commonwealth of Pennsylvania, field inspection notes by a State representative, sketches of the spillway redesign and construction progress photos.

2.3 Operation

No formal operating procedures were included in the information obtained from DER. The Owner's representative, Mr. David Hughes, stated that the reservoir outlet works are used for flood abatement and to maintain a minimum flow in the East Branch of Chester Creek. Discharge rating curves for the spillway and outlet conduit are unavailable and there are no flow or water level measuring devices present at the site.

2.4 Evaluation

- a. Availability. All information made available was obtained from DER.
- b. Adequacy. The available information (listed in Section 2.1.a) combined with visual observations during the inspection and conversations with the Owner's representative are considered adequate for a Phase I investigation.
- c. Validity. There appears to be no reason to question the validity of the data obtained from DER.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Township Line Dam took place on June 12, 1979. At the time of inspection, the reservoir water surface was approximately two inches above the spillway crest. The dam was found to be constructed in general conformance with the available drawings. No underwater areas of the dam were inspected.

The observations and comments of the field inspection team are in the checklist which is Appendix B of this report. The appearance of the facility indicates that the dam and its appurtenances are not well maintained.

b. Dam. The entire earth embankment is overgrown with heavy brush and tall grass. A few trees up to 25 feet tall are growing on the downstream embankment slope adjacent to the spillway. The hand-placed riprap on the upstream slope exhibits evidence of displacement perpendicular to the prevailing grade line. The riprap is missing on the upstream slope from the dam crest to the water line in the vicinity of the intake tower access bridge. It is apparent, at many locations, that the riprap had been reset since the dam was put in service. There is no evidence of uncontrolled seepage or slope misalignments, however, observations were severely limited due to dense vegetation. Visual inspection of the structure was limited to walking in a foot path along the top of dam and inspecting the upstream and downstream slopes at randomly selected locations. An aerial photo was made for the overall view.

An estimated discharge of 0.1 cfs was observed to be flowing from the 42-inch diameter outlet conduit. This flow could be attributed to a partially open sluice gate or seepage collected by the toe drain system. The 8-inch diameter vitrified clay outlet pipe connected to the toe drain system and located in the old stream bed (according to the drawings) could not be found during the inspection. It appears that the Township Line Road alignment was shifted farther downstream following dam construction and it is possible that the outlet pipe was buried during this reconstruction.

c. Appurtenant Structures. The concrete access bridge to the intake tower is in good condition, however, the steel pipe railing is severely rusted and some sections are missing. The concrete and masonry intake tower, above the water line, is in good condition with no indications of vertical or horizontal misalignments. The gate hoist mechanism could not be observed because the door to the intake tower was locked and the Owner's representative, Mr. David Hughes, did not have the key. According to Mr. Hughes, the gate is operated periodically.

The concrete Ogee spillway appears to be in fair condition. There are a few small holes noted in the Ogee section and there is evidence of slight scour of

the left spillway training wall. There is some minor cracking in the concrete wasteway channel, however, it is in generally good condition.

d. Reservoir. The reservoir perimeter is almost entirely wooded with slopes ranging from 5 to 20 percent. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability, or other features that would significantly affect the storage capacity of the reservoir.

e. Downstream Channel. Township Line Road is located about 200 feet downstream of the dam. The highway spans the combined wasteway and reservoir outlet channels on a reinforced concrete bridge. The bridge consists of two spans each about 12.5 feet wide and 7.5 feet high. There were no obstructions or accumulations of debris noted in the bridge opening at the time of inspection.

Milltown Dam is located on the East Branch of Chester Creek about 2 miles downstream of Township Line Dam. The stream valley between the two dams is narrow with moderate side slopes which are primarily covered with grass and brush. The potential hazard area is located around the periphery of the Milltown Reservoir and downstream of the dam in Milltown, PA. At least 6 homes are located around the Milltown Reservoir and about 10 dwellings and commercial establishments are situated in the valley downstream of the Milltown Dam. Therefore, about 16 homes and businesses and up to 80 people could be affected by floodwaters resulting from failure of Township Line Dam.

SECTION 4

OPERATIONAL FEATURES

4.1 Procedures

Township Line Reservoir is used to maintain a minimum discharge in the East Branch of Chester Creek, for flood abatement during periods of high precipitation and for recreation. Under normal operating conditions, the reservoir is self regulating. The pool elevation fluctuates at or near the spillway crest.

According to the Owner's representative, operation of the reservoir outlet pipe for storage reduction is performed in conjunction with releases from Marsh Creek Reservoir situated on Marsh Creek about 10 miles away. Before anticipated high stream discharges, the Chester County Water Resources Authority, owner of Marsh Creek Dam, reduces the reservoir pool level. The West Chester Area Municipal Water Authority is notified of these releases and then matches or exceeds the additional discharge by operation of the sluice gate at Township Line Dam.

4.2 Maintenance of Dam

According to the Owner's representative, there is no maintenance program for the dam. However, debris obstructing the spillway is removed as it accumulates. The Owners are aware of the extensive vegetative growth on the embankment and its deleterious effect upon dam stability. However, they are presently awaiting the outcome of negotiations for transfer of dam ownership to Chester County before implementing removal of the vegetation.

4.3 Maintenance of Operating Facilities

According to the Owner's representative, the control valves in the intake tower are exercised about every six months and during reservoir pool reductions; the valves are repaired as required.

4.4 Description of any Warning System in Effect

According to the Owner's representative, no flood warning system is in effect at the site. The West Chester Area Municipal Water Authority maintains a USGS rain gauge at Milltown Dam about 2 miles downstream of Township Line Dam. Therefore, the Owner has direct information concerning high rainfall events and personnel are available to initiate monitoring of the Township Line Reservoir during potentially hazardous conditions.

4.5 Evaluation of Operational Adequacy

The heavy vegetative growth covering the entire embankment should be removed. During periods of heavy rainfall, the dam should be monitored and downstream residents alerted in the event of an impending failure.

It appears that the dam is accessible under all weather conditions for inspection and emergency action.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. The design data available for Township Line Dam is limited to a reservoir stage-storage curve included on the construction drawings. Visual inspection of the existing facilities indicates that the dam and appurtenances appear to be built in general conformance with the available construction drawings.

The Township Line Reservoir watershed is a fan-shaped basin with a total drainage area of 2.9 square miles. Elevations range from 550.0 in the upper reaches of the watershed to 414.0 at the normal reservoir level. The watershed is composed of rolling hills typical of piedmont topography. The communities of Green Hill, Kirkland, Morstein and Woodcrest are located in the basin and the suburban residential developments, associated with these communities, extend over the entire watershed.

b. Experience Data. According to the Owner's representative, no discharge or reservoir stage records are maintained for this site and no estimate could be given.

c. Visual Observations. The spillway system appears to be in good condition. On the day of the inspection, there was no evidence of materials which could obstruct the spillway. Observations regarding the downstream channel, spillway and reservoir are discussed in Appendix B and Section 3.

d. Overtopping Potential. The Spillway Design Flood (SDF) for this "Intermediate" size, "High" hazard dam is given as the Probable Maximum Flood (PMF) based upon the dam height, storage capacity and hazard potential.

The peak inflow and outflow rates for the SDF were determined to be 7,673 cfs and 7,235 cfs respectively. Based upon the hydrologic analyses, the spillway is capable of discharging 48 percent of the PMF without overtopping of the embankment.

e. Spillway Adequacy. A review of the hydrologic analysis indicates that the embankment would be overtopped by a maximum of 0.15 feet for about 2 hours during a flood equal to 50 percent of the PMF. Since it is considered unlikely that the embankment would fail during this event, the spillway is classified as "Inadequate" but not "Seriously Inadequate".

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The entire embankment is heavily overgrown with brush and tall grass. A few trees with trunk diameters up to 12-inches are growing on the downstream slope adjacent to the spillway. The tree roots may increase the seepage potential through the embankment and uprooting of the trees by high winds could cause substantial volumes of embankment material to be displaced. There were no indications of downstream seepage, slope misalignments or other unstable conditions noted during the visual inspection. It should be noted that the detection of potentially unstable conditions at this site was severely restricted due to the thick vegetation; therefore, until the overgrowth is removed an opinion on the stability of the dam can not be made.

b. Design and Construction Data. The embankment cross-section geometry appears to be in general conformance with the design drawings cross-section. Information on stability analyses, seepage computations or soil properties is unavailable. According to the drawings, the embankment was constructed with a rock fill toe and VCP drainage system.

c. Operating Records. The Owner was not aware of any operating records associated with this site.

d. Post Construction Changes. No reported past construction changes are included in the information provided by DER.

e. Seismic Stability. The dam is located within Seismic Risk Zone 1 of the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is generally considered to be safe under any expected earthquake loading conditions if it is safe under static loading conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety. The visual inspection and review of the material supplied by DER indicate that Township Line Dam is in fair condition and was built in general conformance with the available drawings.

The spillway is capable of discharging 48 percent of the PMF without overtopping of the earth embankment. The hydrologic analysis indicates that the embankment would be overtopped by 0.15 feet for about two hours during a flood equal to 50 percent of the PMF. It is considered unlikely that the dam would fail during this event, therefore, the spillway is classified "Inadequate", but not "Seriously Inadequate".

The only significant deficiency noted during the visual inspection was the thick vegetation covering the entire embankment which severely restricted detection of potentially hazardous conditions.

b. Adequacy of Information. The available information (listed in Section 2.1.a), combined with visual observations during the inspection and conversations with the Owner's representative, is considered adequate for a phase I investigation.

c. Urgency. Further investigations and recommended remedial measures should be implemented immediately.

d. Necessity for Further Investigations. The stability of the embankment should be reevaluated, if any signs of distress are revealed in the embankment when the overgrowth is removed. Detailed hydrologic and hydraulic studies should be made to determine measures required to pass the PMF safely.

7.2 Recommendations and Proposed Remedial Measures

a. Facilities.

1. The capacity of the spillway should be increased in accordance with the results of further hydrologic and hydraulic studies.
2. The thick vegetation and trees should be removed from the embankment crest and slopes under the guidance of an engineer. If any signs of distress such as seepage, sloughing or cracking are revealed, the stability of the embankment should be reevaluated by a licensed professional engineer experienced in the design and construction of dams.
3. The exact location of the 8-inch diameter vitrified clay outlet pipe connected to the toe drain system should be determined. The pipe

should be regularly inspected to detect any changes in discharge and/or turbidity.

4. The riprap should be replaced where necessary on the upstream slope of the dam.

b. Operation and Maintenance Procedures

1. A program should be initiated for removal of excess vegetation from the embankment on a regular basis.
2. A downstream warning system should be developed. During periods of heavy rainfall, the dam should be monitored and downstream residents should be alerted in the event of an impending failure.

APPENDIX

A

Check List Engineering Data
Design, Construction, Operation
Phase I

NAME OF DAM Township Line Dam
 ID # PA 00625

CHECK LIST
 ENGINEERING DATA
 DESIGN, CONSTRUCTION, OPERATION
 PHASE I

Sheet 1 of 4

ITEM

REMARKS

AS-BUILT DRAWINGS

As-Built drawings limited to one sheet showing the profile of concrete core wall as constructed.

REGIONAL VICINITY MAP

Refer to Appendix E, Plate 1.

CONSTRUCTION HISTORY

The dam was built by Wm. Steele & Son Company between July 1934 and December 1935. Engineer's construction progress reports available from DER files.

TYPICAL SECTIONS OF DAM

Refer to Appendix E.

OUTLETS - PLAIN

DETAILS

CONSTRAINTS

Refer to Appendix E.

DISCHARGE RATINGS

None available

RAINFALL/RESERVOIR RECORDS

Dam owners maintain USGS rain gauge

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	} No data available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	} No data available.
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None
POST CONSTRUCTION/ ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

ITEM	REMARKS
SPILLWAY PLAN	Refer to Appendix E.
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Refer to Appendix E.
MISCELLANEOUS	Material in DER files:
	<ol style="list-style-type: none"> 1. "Application", "Report upon the Application" and "Permit to construct Township Line Dam. 2. Drawings. 3. Construction progress reports, state construction inspection reports, correspondence between state and designer. 4. Photographs. 5. As-Built drawing of concrete core wall.

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Sheet 1 of 11

Name Dam Township Line Dam County Chester State Pennsylvania National ID # PA 00625
Type of Dam Compacted Earth Hazard Category High
Date(s) Inspection June 12, 1979 Weather Clear Temperature 71°

Pool Elevation at Time of Inspection 414.1⁺ M.S.L. Tailwater at Time of Inspection 386⁺ M.S.L.

Inspection Personnel:

Mr. John J. Williams

Mr. Leonard Beck

Mr. Robert Bowers

Robert Bowers Recorder

Remarks:

Accompanied by Mr. Dave Hughes, Manager, West Chester Area Municipal Water Authority.

CONCRETE/MASONRY DAMS

Sheet 2 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

ANY NOTICEABLE SEEPAGE	N/A	
------------------------	-----	--

STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
--	-----	--

DRAINS	N/A	
--------	-----	--

WATER PASSAGES	N/A	
----------------	-----	--

FOUNDATION	N/A	
------------	-----	--

CONCRETE/MASONRY DAMS

Sheet 3 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

Sheet 4 of 11

<u>VISUAL EXAMINATION OF</u>		<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SURFACE CRACKS		None observed	None
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE		None observed	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES		None observed	None
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST		No misalignments noted	None
RIPRAP FAILURES		Riprap appears to have been displaced in a direction perpendicular to the prevailing grade line. However, it appears to be providing adequate pro- tection.	None

EMBANKMENT

Sheet 5 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
------------------------------	---------------------	-----------------------------------

JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems noted	None
---	-------------------	------

ANY NOTICEABLE SEEPAGE	None observed	None
------------------------	---------------	------

STAFF GAGE AND RECORDER	None	None
-------------------------	------	------

DRAINS	The 8" Ø VCP outlet connected to toe drain system could not be located. May have been buried during road realignment.	Locate drain & monitor discharge for change in flow or turbidity.
--------	--	--

OUTLET WORKS

Sheet 6 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Concrete head wall of outlet conduit in fair condition.	None
INTAKE STRUCTURE	Stone masonry intake tower in good condition. Pipe railing on access bridge severely corroded.	None
OUTLET STRUCTURE	Intake tower contains outlet control valves.	None
OUTLET CHANNEl	Slight vegetative growth in channel. Concrete and riprapped sections in fair condition	None
EMERGENCY GATE	The sluice gate is operable and is exercised at least once every six months according to Owner's represen- tative.	None

UNIGATED SPILLWAY

Sheet 7 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE WEIR	Some small holes noted in concrete of Ogee section.	None
APPROACH CHANNEL	Slight siltation, clear of obstructing debris.	None
DISCHARGE CHANNEL	Slight vegetative growth in channel. 7-step concrete cascade and plunge pool in fair condition.	None
BRIDGE AND PIERS	Concrete bridge and pier 200 ft. d/s of dam in good condition. No debris in bridge opening.	None

GATED SPILLWAY

Sheet 8 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
------------------------------	---------------------	-----------------------------------

CONCRETE SILL		
---------------	--	--

N/A

APPROACH CHANNEL		
------------------	--	--

N/A

DISCHARGE CHANNEL		
-------------------	--	--

N/A

BRIDGE AND PIERS		
------------------	--	--

N/A

GATES AND OPERATION EQUIPMENT		
----------------------------------	--	--

N/A

INSTRUMENTATION

Sheet 9 of 11

<u>VISUAL EXAMINATION</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
---------------------------	---------------------	-----------------------------------

MONUMENTATION/SURVEYS	N/A	
-----------------------	-----	--

OBSERVATION WELLS	N/A	
-------------------	-----	--

WEIRS	N/A	
-------	-----	--

PIEZOMETERS	N/A	
-------------	-----	--

OTHER	N/A	
-------	-----	--

RESERVOIR

Sheet 10 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
------------------------------	---------------------	-----------------------------------

SLOPES

The slopes vary from a maximum of about 20% to a minimum of about 5 percent around the perimeter of the lake.

None

SEDIMENTATION

The entire perimeter of the lake is wooded. There is no evidence of excessive sediment deposition.

None

DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The wasteway and outlet channels flow through the bridge for Township Line Road about 200 feet downstream of the dam. Milltown Dam & Reservoir are located about 2 miles downstream of Township Line Dam.	None
SLOPES	The channel gradient between the Township Line Dam spillway and Milltown Reservoir is about 0.4 percent. The stream valley between the two dams is narrow with moderate side slopes which are primarily covered with grass and brush.	None
APPROXIMATE NO. OF HOMES AND POPULATION	There are about 6 homes situated around Milltown Reservoir and about 10 dwellings and businesses located immediately downstream of Milltown Dam. The estimated population is about 80 people.	A formal warning system should be developed and implemented. Procedures for evacuating residents within the potential flood area should be implemented.

APPENDIX

C

Hydrologic & Hydraulic Data

TABLE OF CONTENTS - APPENDIX C

PMP CALCULATIONS

SHEET 1

SNYDER COEFFICIENTS

SHEET 1

HEC - 1 DAM SAFETY VERSION
COMPUTER OUTPUT

SHEETS 2-5

STAGE STORAGE INFORMATION

SHEET 6

HYDROLOGY CALCULATIONS

Drainage Basin (Area planimetered from USGS) = 2.9 sq. mi.

PMP Calculations (HMS REPORT 33)

Area is in Zone 6.

∴ 24-hour, 2.00 sq mile PMP = 23.5 inches

HR.	%	RAINFALL	Δ RAINFALL
6	113	26.5	26.5
12	123	28.9	2.4
24	132	31.0	2.1
48	142	33.4	2.4

SNYDER COEFFICIENTS (information provided by Balt. COE, Area 10)

$$C_p = 0.60$$

$$C_t = 1.25$$

$$t_p = C_t (LL_{ca})^{0.3}$$

$$t_p = 1.25 [3.3 (1.6)]^{0.3}$$

$$t_p = 2.0$$

.....
 FLOOD HYDROGRAPH PACKAGE (FEC-1)
 DATA SAFETY VERSION JULY 1978
 LAST MODIFICATION 25 SEP 78

NATIONAL DAM INSPECTION PROGRAM									
TOWNSHIP LINE DAM									
PER HYDROGRAPH									
1	150	0	10	0	0	0	0	0	0
2	1	0	1	0	0	0	0	0	0
3	1	0	1	0	0	0	0	0	0
4	1	0	1	0	0	0	0	0	0
5	1	0	1	0	0	0	0	0	0
6	1	0	1	0	0	0	0	0	0
7	1	0	1	0	0	0	0	0	0
8	1	0	1	0	0	0	0	0	0
9	1	0	1	0	0	0	0	0	0
10	1	0	1	0	0	0	0	0	0
11	1	0	1	0	0	0	0	0	0
12	1	0	1	0	0	0	0	0	0
13	1	0	1	0	0	0	0	0	0
14	1	0	1	0	0	0	0	0	0
15	1	0	1	0	0	0	0	0	0
16	1	0	1	0	0	0	0	0	0
17	1	0	1	0	0	0	0	0	0
18	1	0	1	0	0	0	0	0	0
19	1	0	1	0	0	0	0	0	0
20	1	0	1	0	0	0	0	0	0
21	1	0	1	0	0	0	0	0	0
22	1	0	1	0	0	0	0	0	0
23	1	0	1	0	0	0	0	0	0

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

.....
 DUNIFF HYDROGRAPH AT INFLOW
 ROUTE HYDROGRAPH TO OUTFLOW
 END OF NETWORK

.....
 FLOOD HYDROGRAPH PACKAGE (FHC-1)
 DAY SAFETY VERSION JULY 1976
 LAST MODIFICATION 25 SEP 78

RUN DATE 07/03/79
 TIME 08.01.24.

NATIONAL DAM INSPECTION PROGRAM
 TOWNSHIP LINE DAM
 PAF HYDROGRAPH

JOB SPECIFICATION									
NO	NUM	MIN	LOA	IND	MIN	WETC	INLT	IPUT	NSTAN
150	0	30	0	0	0	0	0	0	0
	JOPER		Net	LOMT	TRACE				
	5	0	0	0	0				

MULTI-PLAN ANALYSIS TO BE PERFORMED

	PLAN	PLAN	PLAN	PLAN	PLAN	PLAN	PLAN	PLAN	PLAN
PLAN	0.20	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05

.....

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO TOWNSHIP LINE DAM RESERVOIR

ISTAD	ICOMP	TECOM	ITAP	JPLT	JPUT	INAME	INSTAG	TAUTO
INFLOW	0	0	0	0	0	1	0	0

HYDROGRAPH DATA									
IMR20	IMR5	IMR10	SNAP	TSODA	TSODC	RATIO	INR20	ISAME	LOCAL
1	1	2.00	0.00	2.00	0.00	0.000	0	0	0

PRECIP DATA

SPR	SN	SN	SN	SN	SN	SN	SN	SN	SN
0.00	23.00	113.00	123.00	132.00	147.00	0.00	0.00	0.00	0.00

LOSS DATA

LRMT	STRA	PLTR	MTLO	EMIN	STRA	MTLO	STRA	CNSTL	ALRMT	MTLO
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00

UNIT HYDROGRAPH DATA

TP	2.00	CA	0.00	MTLO	0
STRA	-1.50	0.0000	-0.00	MTLO	2.00

UNIT HYDROGRAPH 23 END-OF-PERIOD ORIGINATES. LAGE 1.00 MOUNT. CO. 0.00 VOL. 1.00									
MTLO	STRA	PLTR	MTLO	EMIN	STRA	MTLO	STRA	CNSTL	ALRMT
157.	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00
120.	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00
0.	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00

END-OF-PERIOD FLOW

WQ.DA H.M.N PERIOD RAIN EXCS LOSS COMP Q WQ.DA H.M.N PERIOD RAIN EXCS LOSS COMP Q

SUM 26.70 26.30 2.00 94751.
1 678.11 617.11 61.11 2483.051

.....

HYDROGRAPH ROUTING

ROUTING THROUGH TOWNSHIP LINE DAM RESERVOIR

INSTAG	ICOMP	IFCON	ITAPE	JPLT	JOMT	INAME	ISTAGE	TAUTO
OUTFLO	1	0	0	0	0	1	0	0
ROUTING DATA								
QLOSS	0.00	0.00	1	1	0	0	LSTP	0
QLOSS	0.00	0.00	1	1	0	0	LSTP	0
NTSOL	1	0	LAG	AWC	1	FSM	STORA	ISPHAT
1	0	0	0.000	0.000	0.000	-615.	0	0
CAPACITY	0.	12.	61.	174.	341.	597.	1150.	2000.
ELEVATION	390.	345.	419.	405.	410.	414.	420.	425.
CAREL SMOID CODE EXPS ELEV								
410.0	40.0	3.4	1.5	0.0	0.0	0.0	0.0	0.0

DAM DATA
TOPEL COOJ EXPO DAMWID
420.0 3.1 1.5 530.

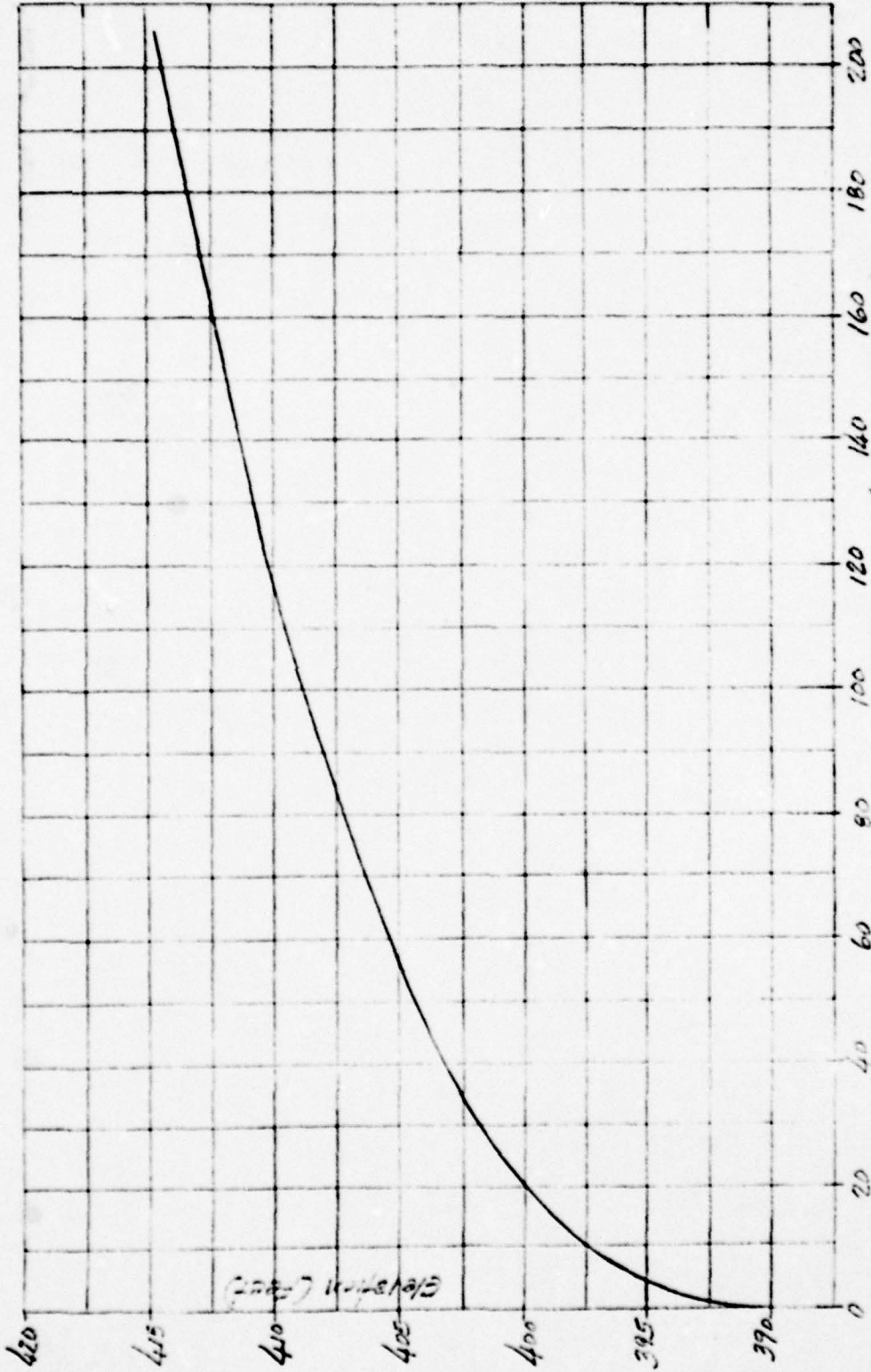
PEAK OUTFLOW IS	1957. AT TIME	03.50 HOURS
PEAK OUTFLOW IS	1960. AT TIME	03.50 HOURS
PEAK OUTFLOW IS	2321. AT TIME	03.00 HOURS
PEAK OUTFLOW IS	2999. AT TIME	03.00 HOURS
PEAK OUTFLOW IS	3471. AT TIME	03.00 HOURS
PEAK OUTFLOW IS	4704. AT TIME	02.50 HOURS
PEAK OUTFLOW IS	5595. AT TIME	02.50 HOURS
PEAK OUTFLOW IS	6010. AT TIME	02.50 HOURS
PEAK OUTFLOW IS	7235. AT TIME	02.50 HOURS

Operation	Station	Area	Play	Ratios Applied to Flows								
				Ratio 1	Ratio 2	Ratio 3	Ratio 4	Ratio 5	Ratio 6	Ratio 7	Ratio 8	Ratio 9
Inflow		2.90	1	1535.	2302.	3062.	3837.	4604.	5371.	6139.	6906.	7673.
		7.51		4.6461	65.191	86.911	108.641	130.371	152.101	173.831	195.561	217.291
Outflow		2.90	1	1057.	1680.	2321.	2999.	3671.	4364.	5055.	5746.	6436.
		7.51		7.2911	67.571	65.721	64.921	109.411	133.271	156.811	182.971	206.861

PLAY 1	INITIAL VALUE	SPILLWAY COST	TOP OF DAM
ELEVATION	619.00	619.00	620.00
STORAGE	597.	597.	1159.
DATE OF	0.	0.	2792.

[illegible]

SUBJECT	SHEET	BY	DATE	JOB NO.
Township Line Dam	6	J	8/27/79	

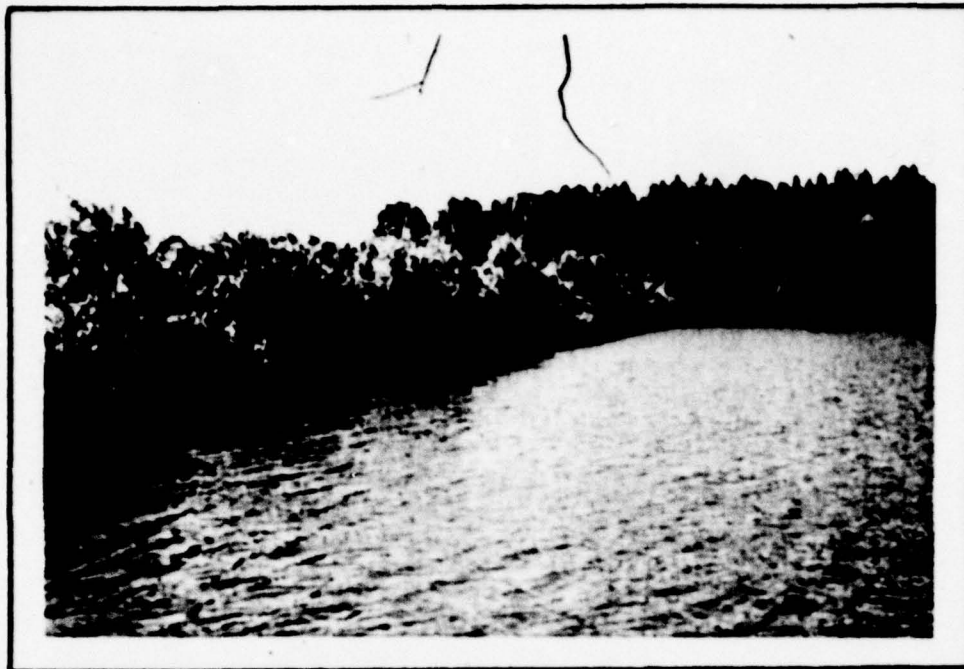


From I.S. Walker Reading 500 ft. Phila. Pa. 7/9/75	Elev.	Storage (Millions of Gallons)	Storage (Am. 150)
	420	374	1150
	414	142	527
	410	117.5	361
	405	56.5	174
	400	20	61
	395	4	12
	390	0	0

APPENDIX

D

Photographs



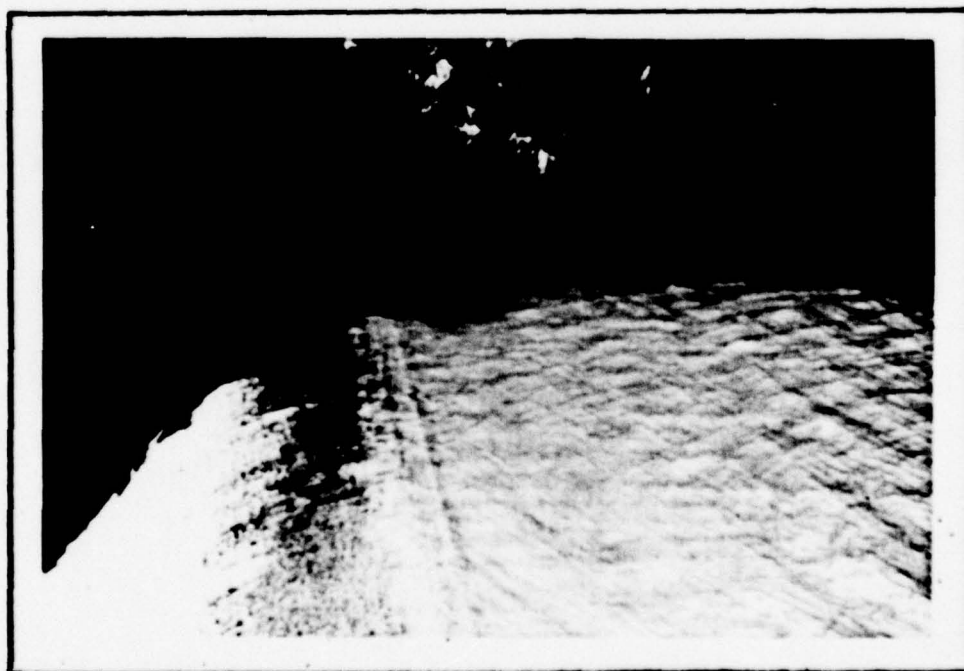
*VIEW SHOWING THE IMPOUNDMENT, GATEHOUSE,
CATWALK AND THE HEAVILY OVERGROWN
EMBANKMENT OF THE DAM*



*CATWALK AND GATEHOUSE WITH BROKEN
RAILING ON THE RIGHT SIDE OF THE CATWALK*



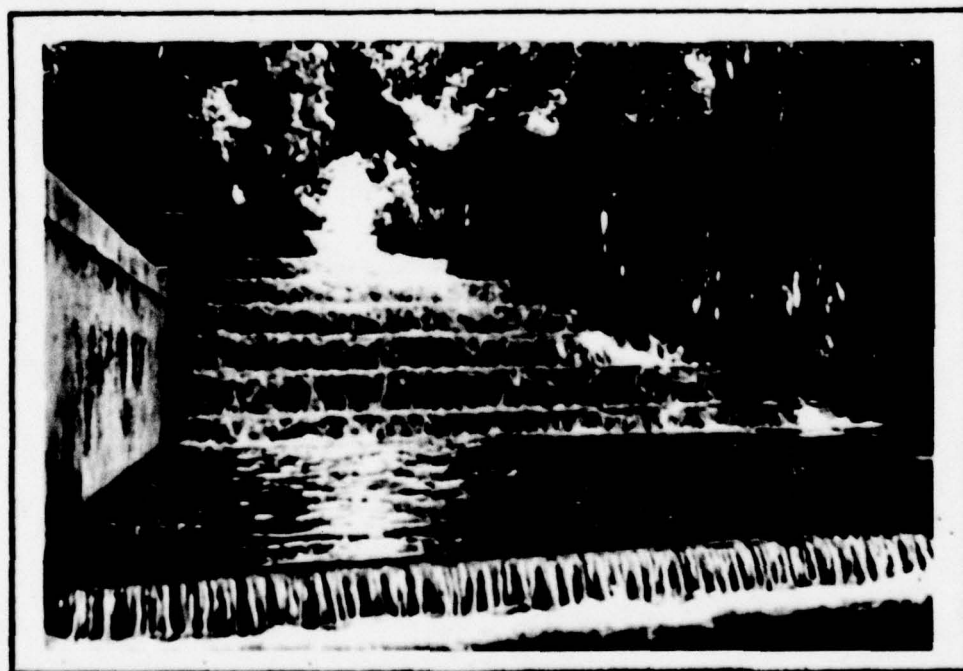
*UPSTREAM EMBANKMENT SLOPE TO THE
LEFT OF THE CATWALK SHOWING HEAVY
VEGETATION, LACK OF VEGETATION, AND RIPRAP*



*VIEW OF THE SPILLWAY AS SEEN
FROM THE CREST OF THE DAM*



*LOOKING UPSTREAM IN THE SPILLWAY
OUTLET CHANNEL AT THE SPILLWAY*



*STEPPED PORTION OF THE SPILLWAY
OUTLET CHANNEL ABOUT 200 FEET
DOWNSTREAM OF THE SPILLWAY*



*DOWNSTREAM OUTLET OF THE
RESERVOIR DRAIN SYSTEM*



*TWIN BOX CULVERT HIGHWAY BRIDGE
ABOUT 300 FEET DOWNSTREAM OF THE DAM
ON THE SPILLWAY OUTLET CHANNEL*

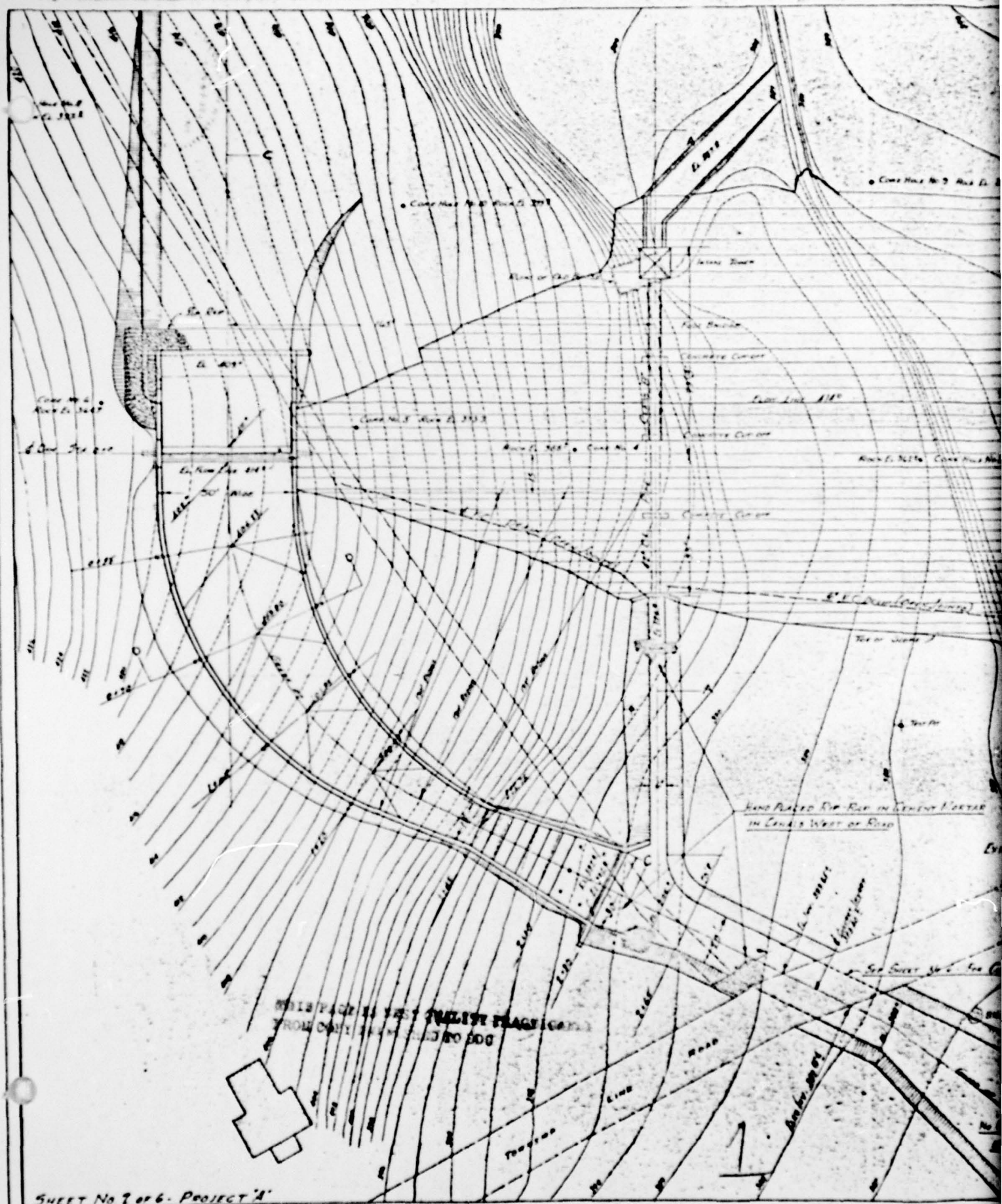
APPENDIX

E

Drawings

TABLE OF CONTENTS - APPENDIX E

REGIONAL VICINITY MAP	PLATE 1
GENERAL PLAN OF DAM AND SPILLWAY	PLATE 2
LONGITUDINAL SECTIONS OF DAM AND SPILLWAY	PLATE 3
CROSS SECTIONS OF DAM	PLATE 4
PROFILE OF CONCRETE COREWALL AS CONSTRUCTED	PLATE 5
GENERAL PLAN OF DAM AND SPILLWAY SHOWING PROBLEMS AREAS	PLATE 6
TOP OF DAM PROFILE LOOKING DOWNSTREAM	PLATE 7



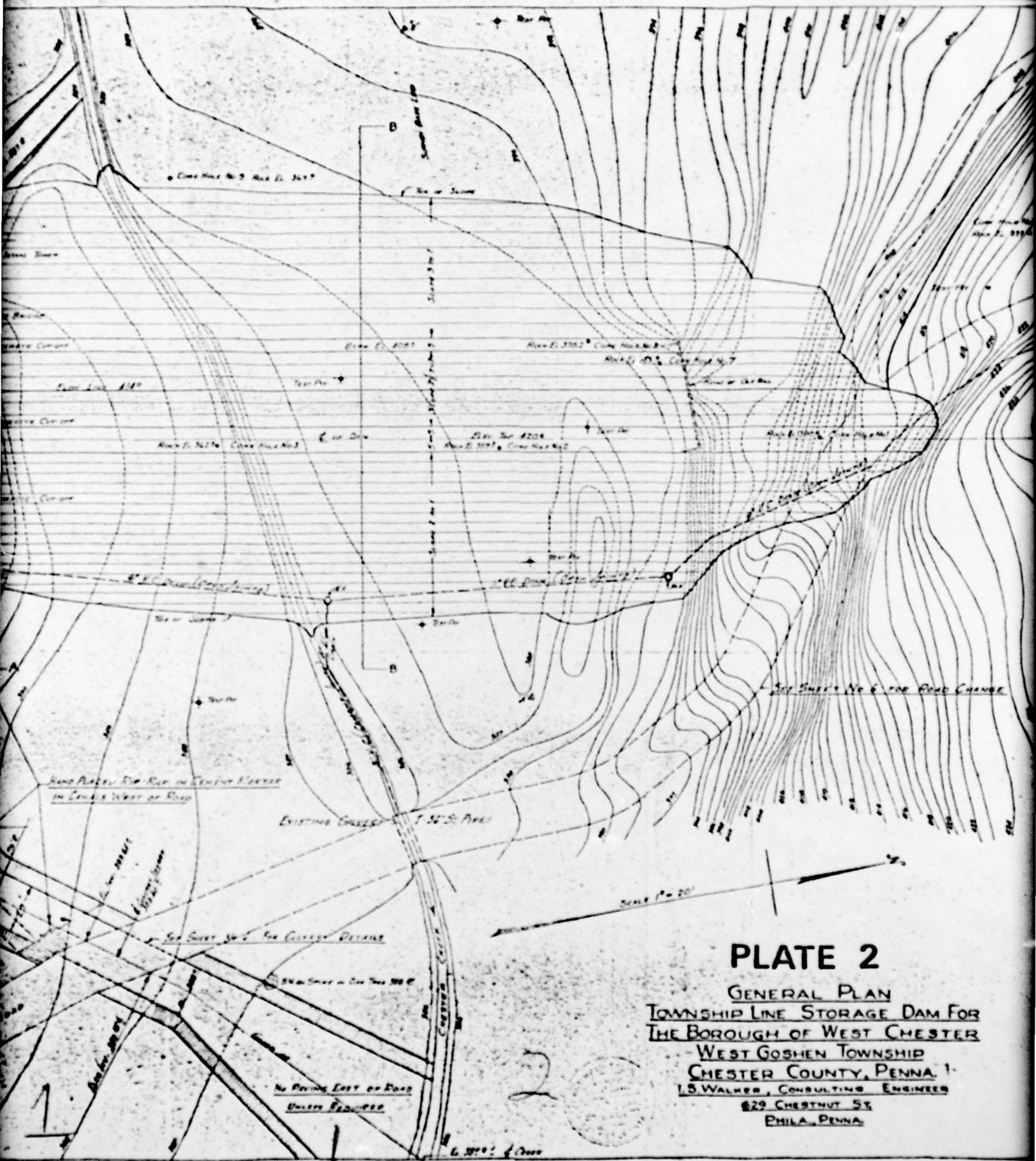
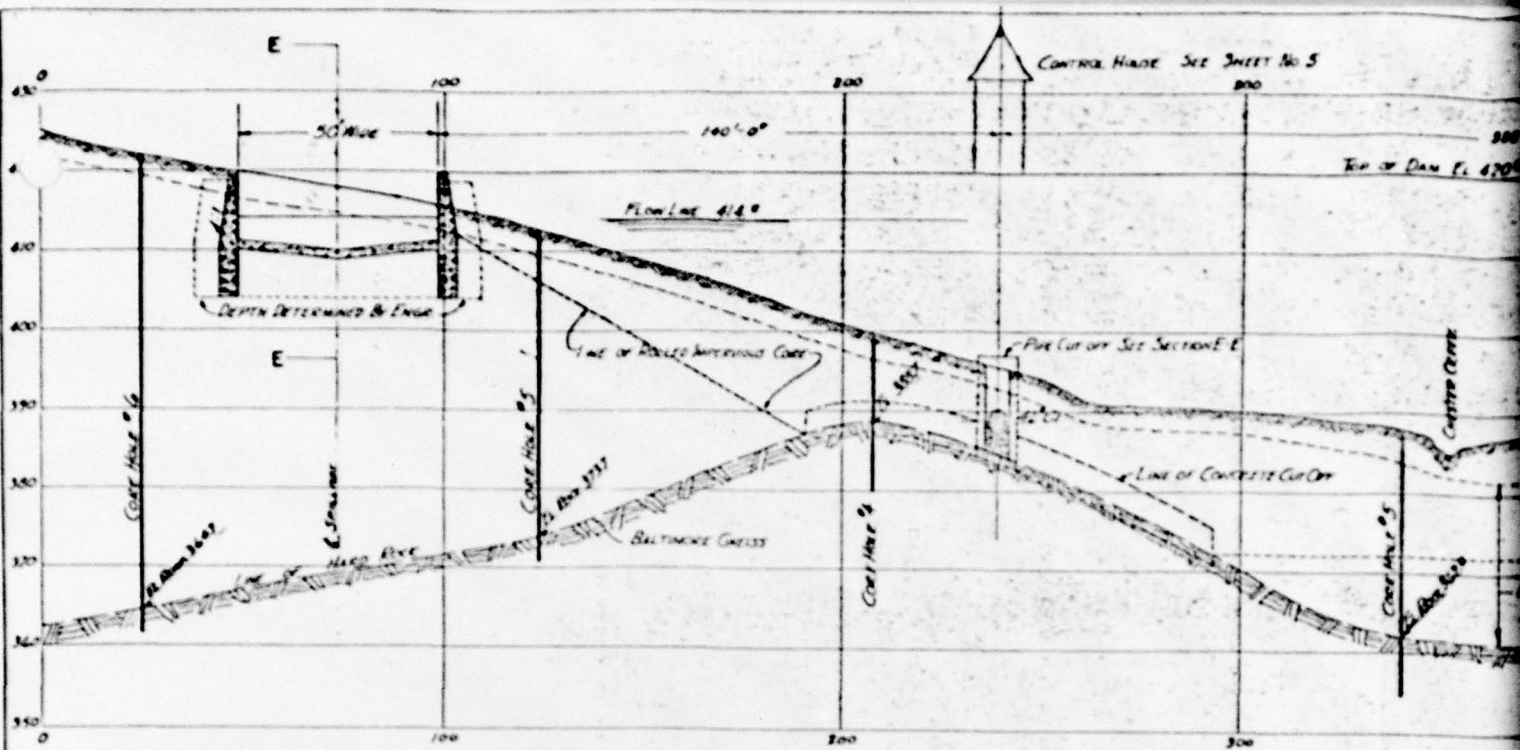
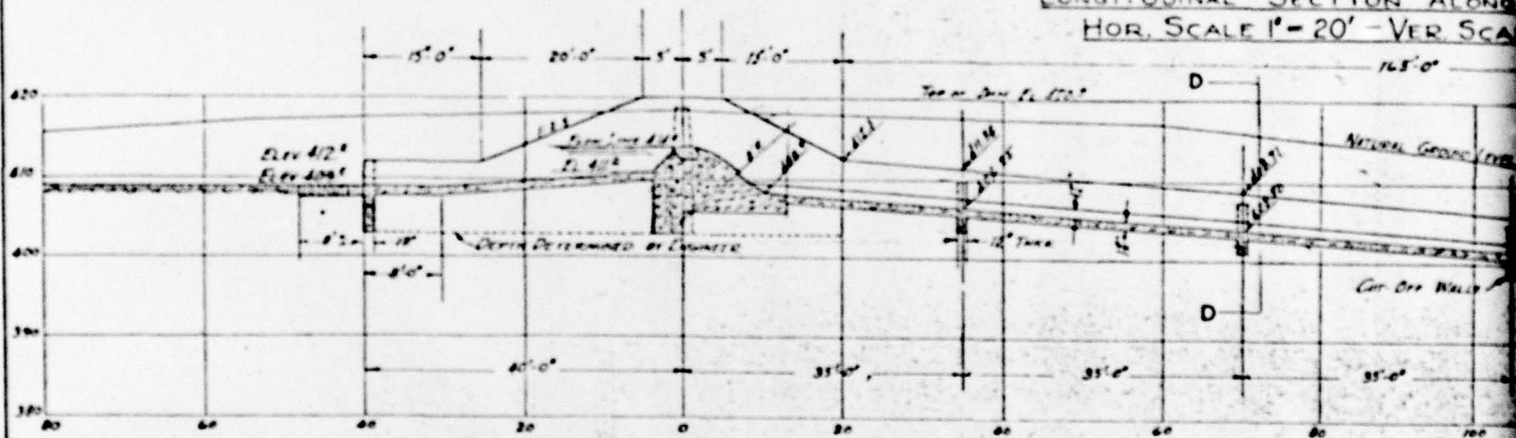


PLATE 2

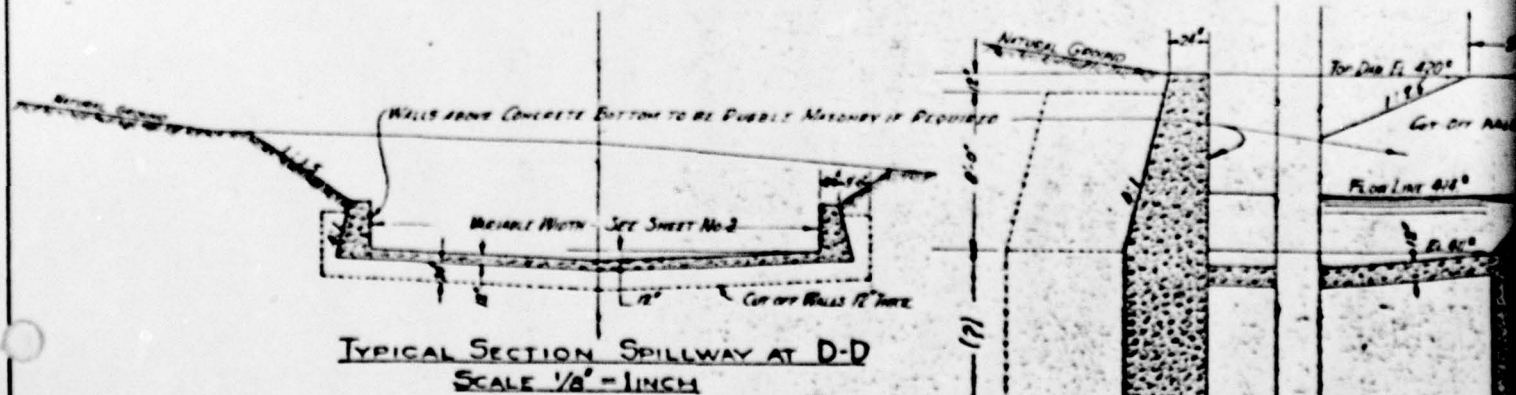
GENERAL PLAN
TOWNSHIP LINE STORAGE DAM FOR
THE BOROUGH OF WEST CHESTER
WEST GOSHEN TOWNSHIP
CHESTER COUNTY, PENNA.
I. S. WALKER, CONSULTING ENGINEER
829 CHESTNUT ST.
PHILA., PENNA.



LONGITUDINAL SECTION ALONG
HOR. SCALE 1" = 20' - VER. SCALE 1" = 20'



LONGITUDINAL SECTION ALONG D
SCALE 1/8" = 1' FOR



TYPICAL SECTION SPILLWAY AT D-D
SCALE 1/8" = 1' INCH

THIS PAGE IS BEST QUALITY PHOTOGRAPH
FROM COPY FURNISHED TO LDC

WITH THE ABOVE SCALE THE DISTANCE TO THE
11' SPILLWAY IS 11' 8" 3/4" 1/2"

SECTION
SCALE

Set Section E

Fig. 100

300 400 500 600

360 370 380 390 400 410 420 430

Line of Concrete Cut-Off

Line of Rolled Impervious Core

Line of Hired Rock

Line of Hired Clay

Natural Ground

Baltimore Grits

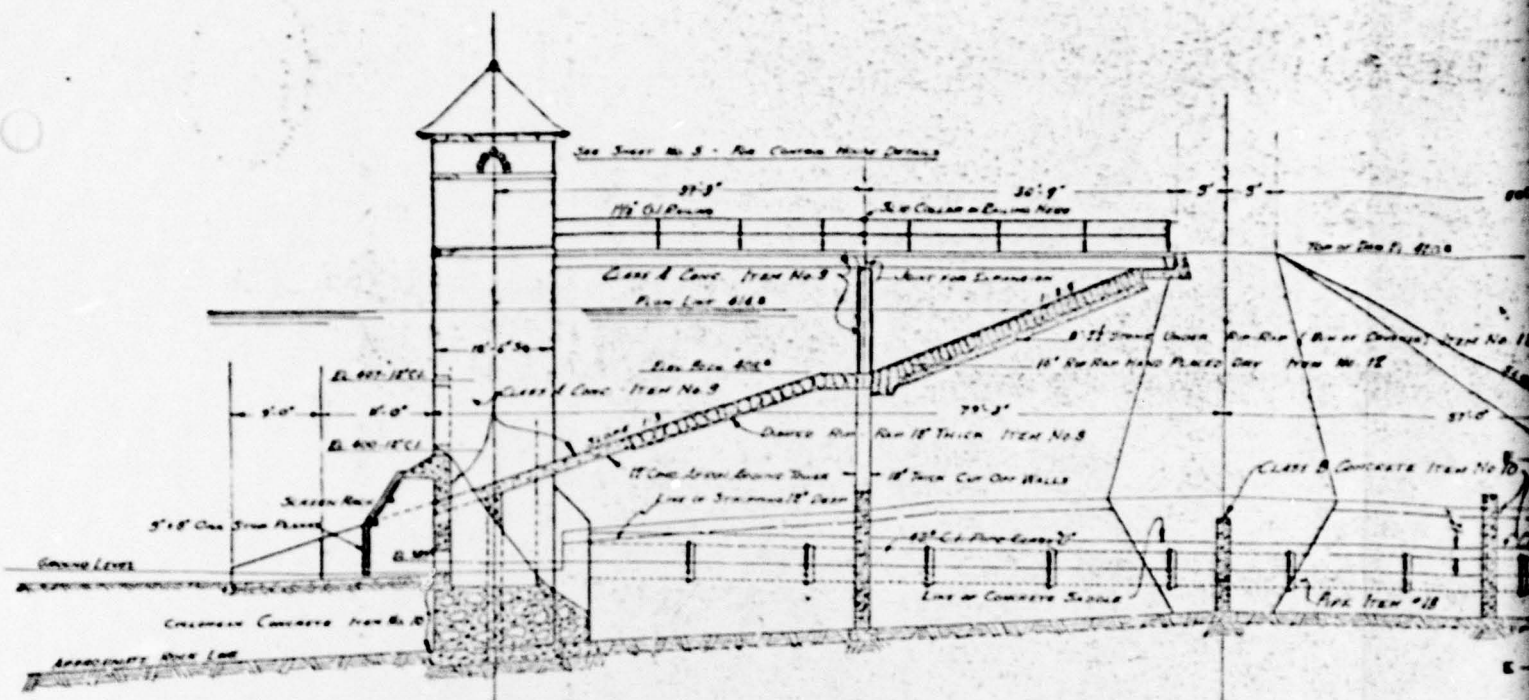
Fig. 100

LONGITUDINAL SECTION ALONG CENTER LINE OF SPILLWAY

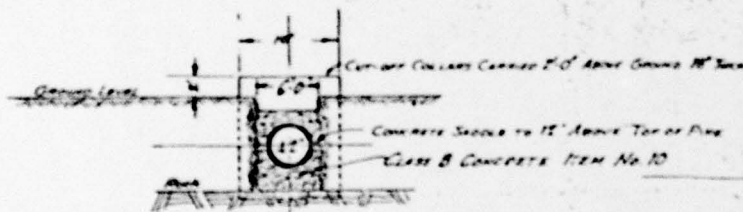
[illegible]

LONGITUDINAL SECTIONS
TOWNSHIP LINE STORAGE DAM FOR
THE BOROUGH OF WEST CHESTER
WEST GOSHEN TOWNSHIP
CHESTER COUNTY, PENNA.
L. S. WALKER, CONSULTING ENGINEER
629 CHESTNUT ST.
PHILA., PENNA.

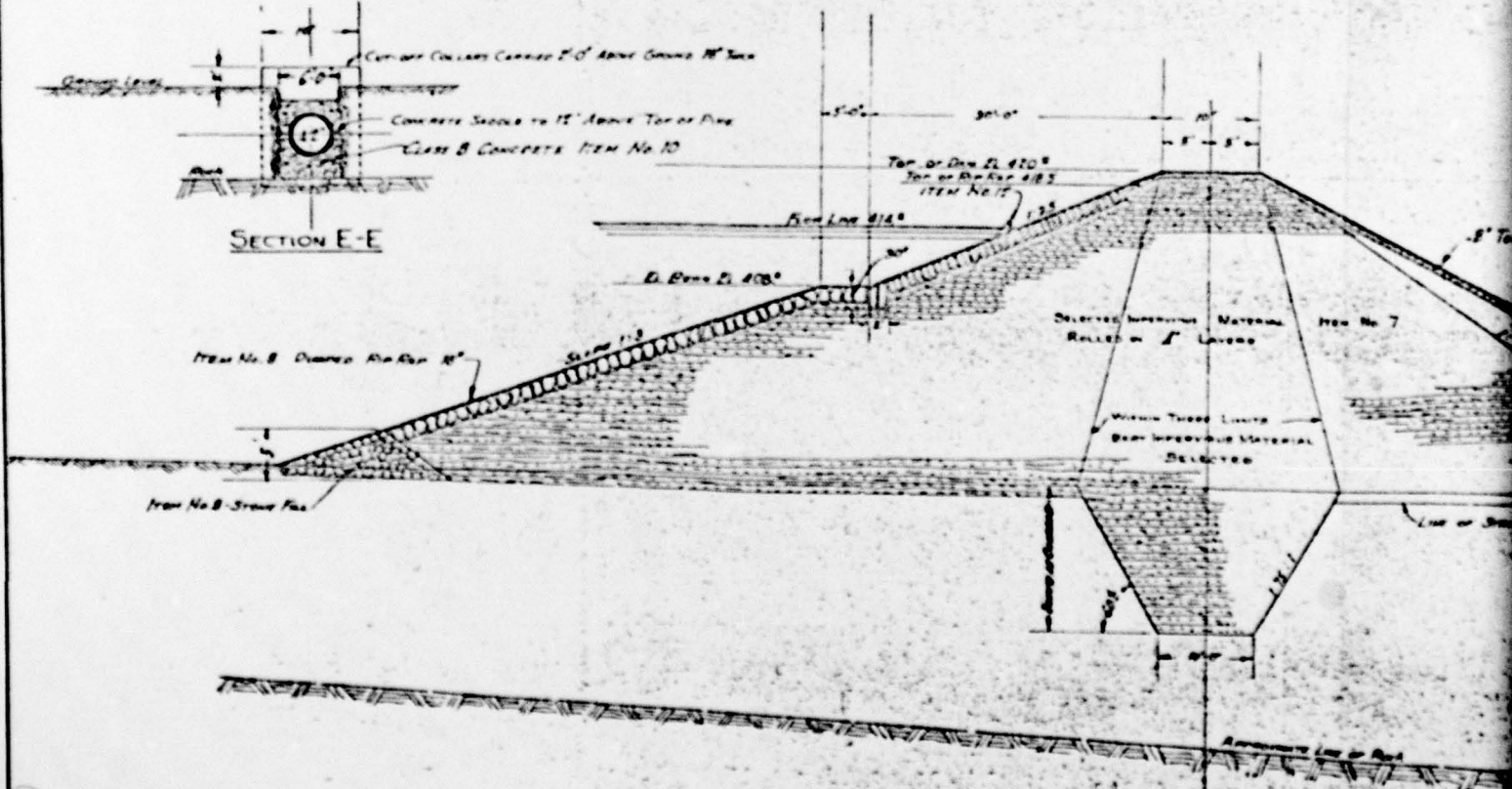
2



SECTION AT A-A
SCALE $\frac{1}{8}'' = 1 \text{ FOOT}$



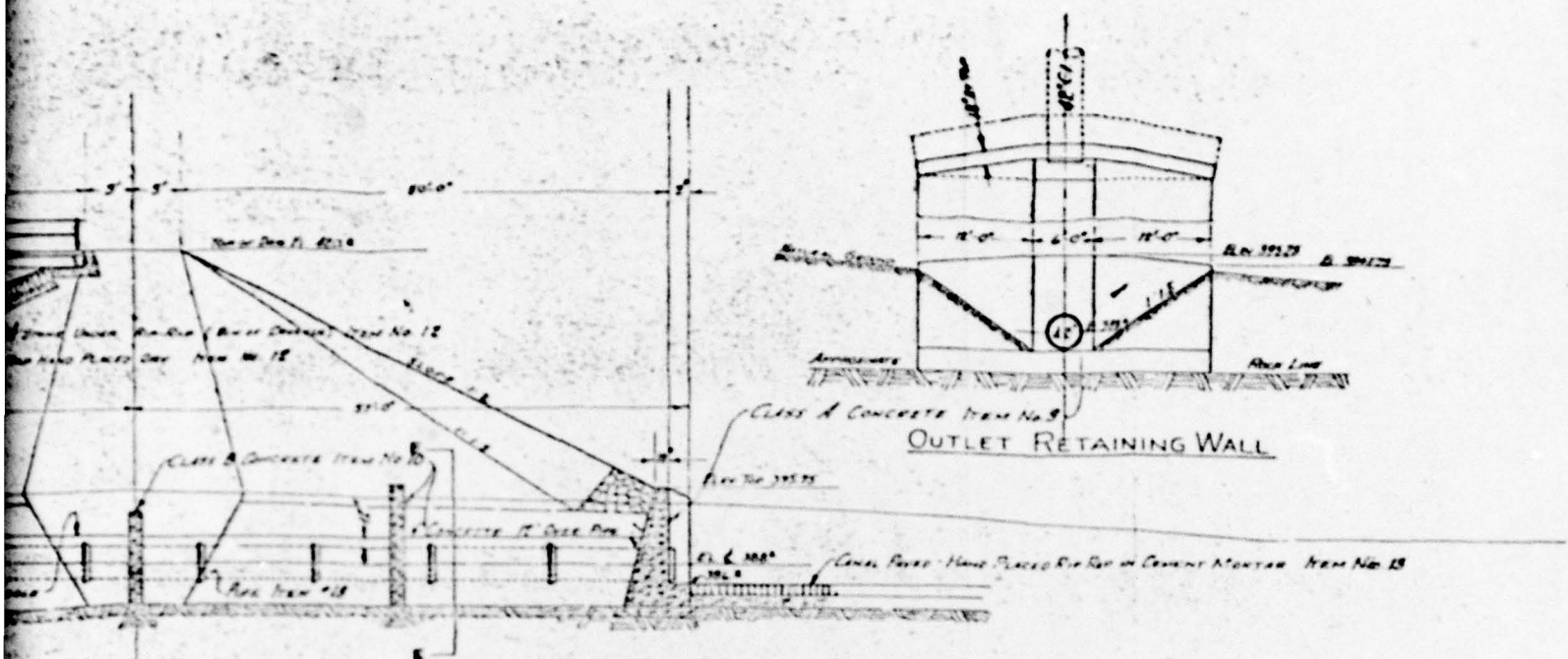
SECTION E-E



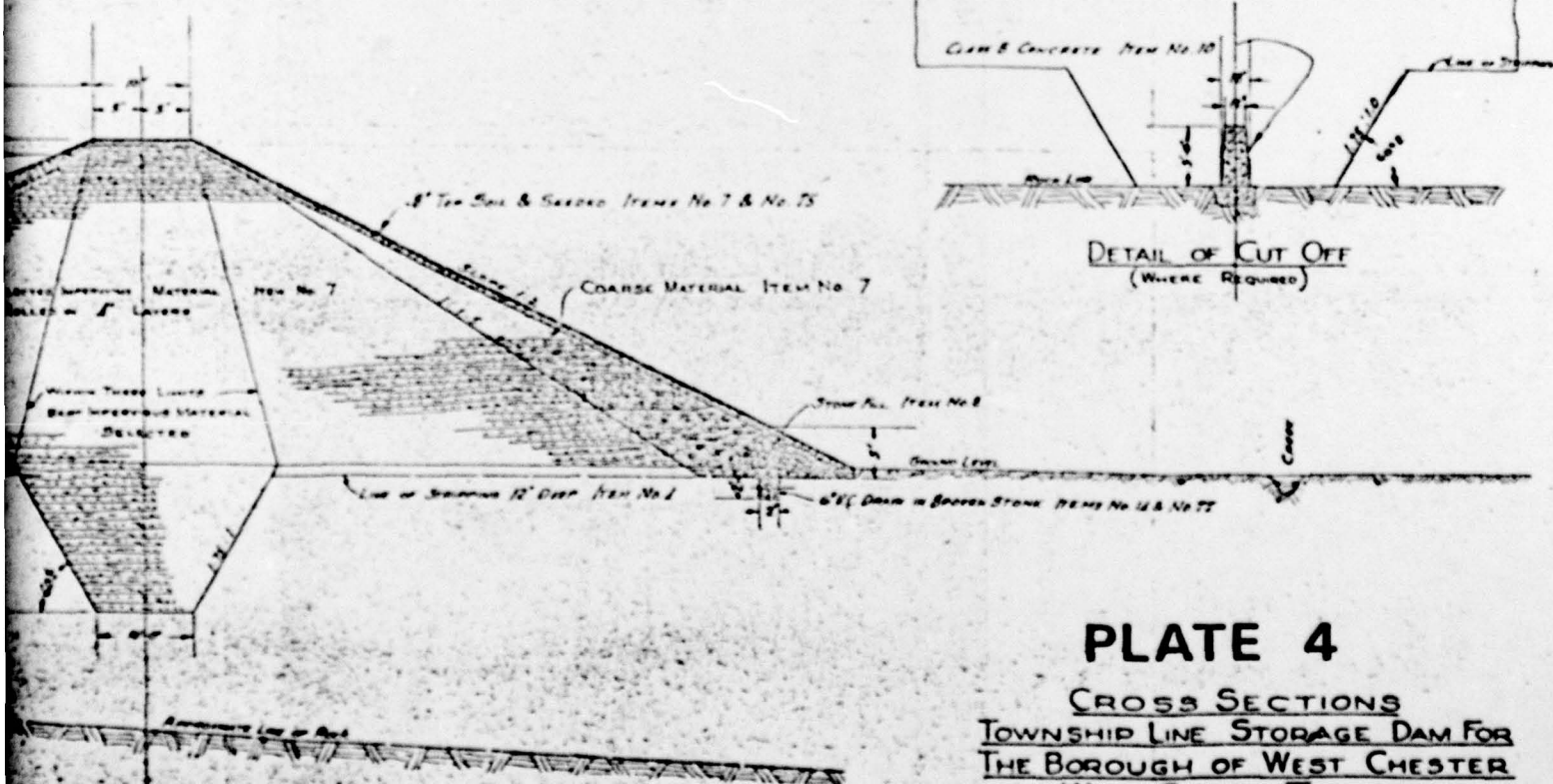
MAXIMUM SECTION AT B-B
SCALE $\frac{1}{8}'' = 1 \text{ FOOT}$

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FROM COPY PUBLISHED 1900

1



CROSS SECTION AT A-A
SCALE 1/8" = 1 FOOT



CROSS SECTION AT B-B
SCALE 1/8" = 1 FOOT

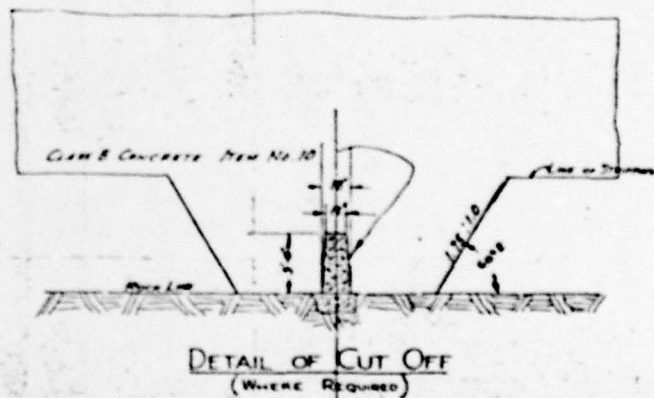


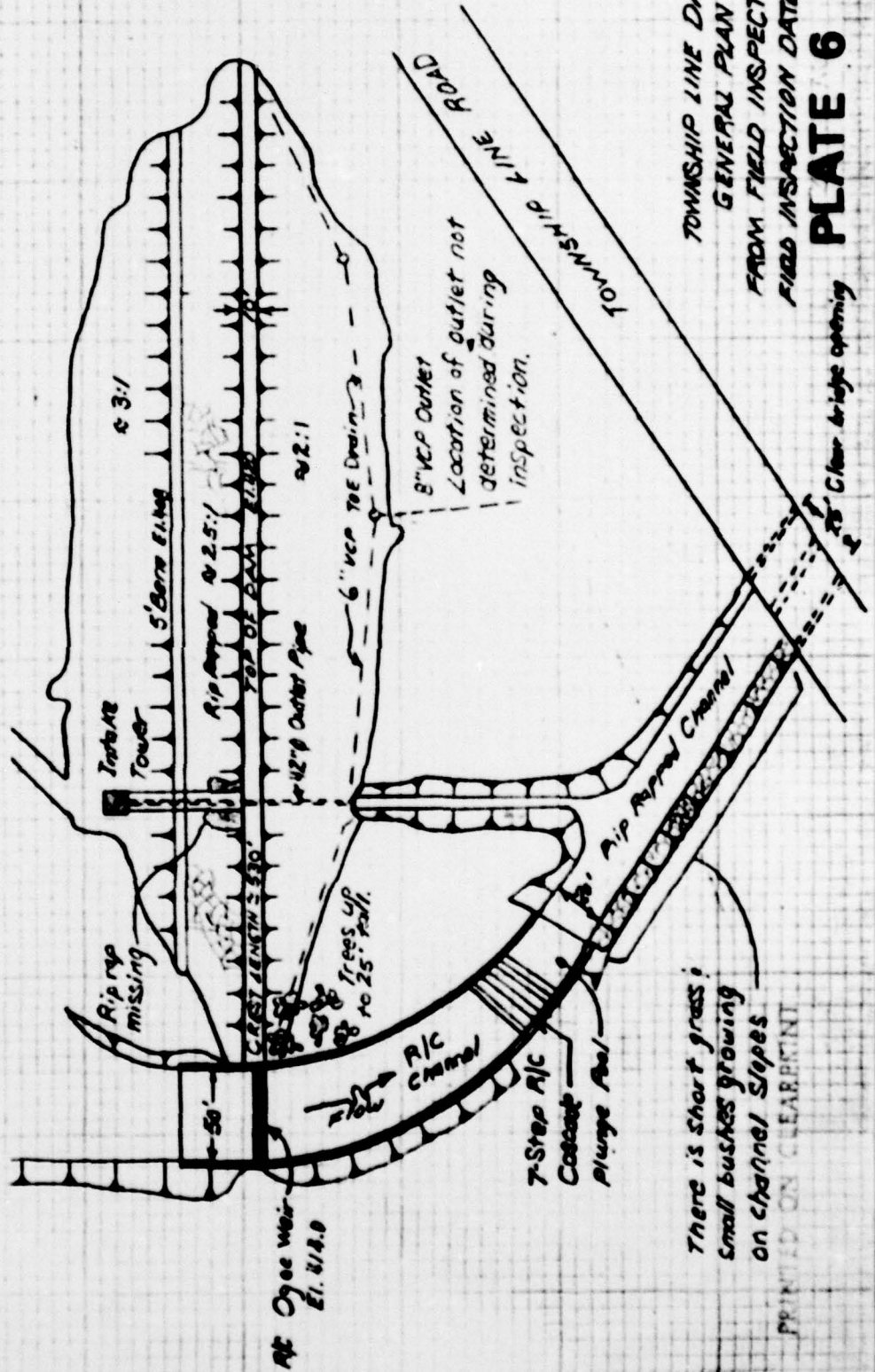
PLATE 4

CROSS SECTIONS
TOWNSHIP LINE STORAGE DAM FOR
THE BOROUGH OF WEST CHESTER
WEST GOSHEN TOWNSHIP
CHESTER COUNTY, PENNA.
J.S. WALKER, CONSULTING ENGINEER
629 CHESTNUT ST.
PHILA. PENNA.



* The entire embankment is overgrown *
with brush, tall grass and small trees.

NORMAL POOL EL 414.0



There is short grass &
small bushes growing
on channel slopes

PRINTED ON CLEARBENT

TOWNSHIP LINE DAM
GENERAL PLAN
FROM FIELD INSPECTION NOTES
FIELD INSPECTION DATE 7/12/77

PLATE 6

25' Clear bridge opening

SUBJECT

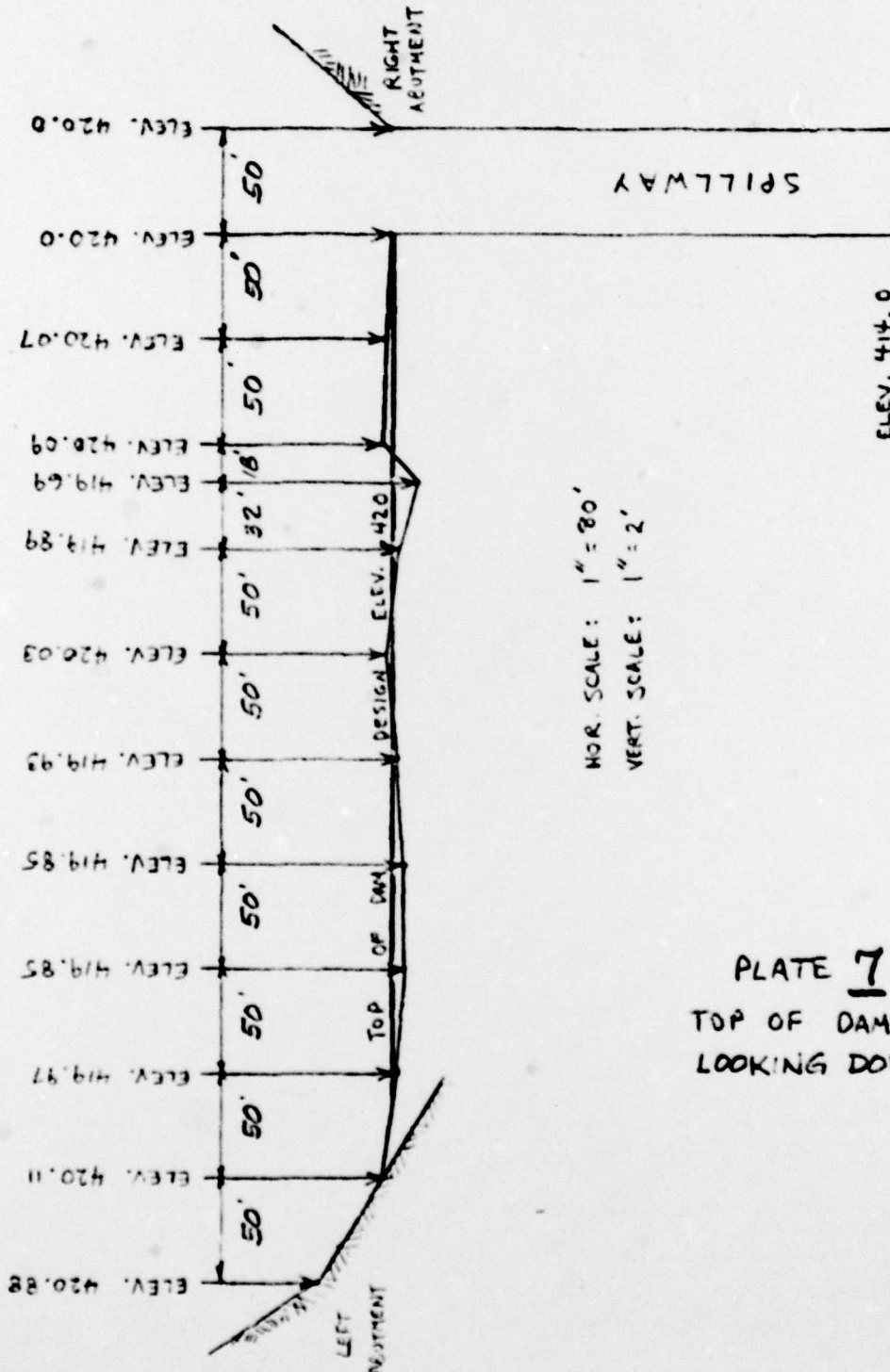
TOWNSHIP LINE DAM

SHEET

BY

DATE

JOB NO.



HOR. SCALE: 1" = 80'
VERT. SCALE: 1" = 2'

PLATE 7
TOP OF DAM PROFILE
LOOKING DOWNSTREAM

APPENDIX

F

Site Geology

SITE GEOLOGY

TOWNSHIP LINE DAM

Township Line Dam is located in the Upland section of the Piedmont physiographic province. Bedrock at the site is a Precambrian gabbroic gneiss and is designated as Baltimore Gneiss on the longitudinal dam section presented in the design drawings. This rock unit has differentially weathered in-situ such that its character varies from a hard rock mass to a soil-like material exhibiting cohesion and/or granulation. The results of the exploratory boreholes at the site indicate that the depth to rock ranges from 10 to 28 feet below the ground surface.

